TITLE OF THE INVENTION

A PRINTING APPARATUS AND METHOD TO PICK UP PAPER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Patent Application No. 2003-36125, filed June 4, 2003, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a printing apparatus, and in particular, to a printing apparatus having a flexible structure of a friction member to classify a plurality of papers according to respective type of the plurality of papers.

2. Description of the Related Art

[0003] Generally, a printing apparatus such as a laser printer and an ink-jet printer comprise a paper-feeding device to individually feed each paper to a printing stage of the printing apparatus.

[0004] In general, such a paper feeding device comprises a paper cartridge section on which a plurality of papers are loaded, at least one pick-up roller to feed the plurality of papers loaded on the paper cartridge section in one direction, and at least one friction member provided at a predetermined angle in relation to the paper transfer direction so as to individually classify the plurality of papers fed and forwarded by the pick-up roller.

[0005] The friction member is provided at a predetermined angle in relation to a bottom surface of the paper cartridge, i.e., to a horizontal surface on which the papers are loaded. When the leading edge of a paper picked up by the pick-up roller comes into contact with the friction member, a paper is separated from the plurality of papers by the frictional force, and then moved to a printing section.

[0006] However, because the installation angle of the friction member is typically fixed and unchangeable, it is difficult to dynamically accommodate various types of print papers. Specifically, when the loaded paper is thick and stiff, or for example, glossy, sometimes the paper may not be picked up due to the stiffness of the paper because the resistance between the leading edge of the paper to be picked up and the friction member is too large.

[0007] Further, in a case where the paper is relatively thin as compared to a glossy paper, two or more sheets of paper may be concurrently picked up.

SUMMARY OF THE INVENTION

[0008] Accordingly, the present invention is provided to solve the above-mentioned and/or other problems of the related art, and an aspect of the present invention provides a printing apparatus having an improved flexible structure to accommodate various types of papers by dynamically changing a structure of a friction member in accordance with the types of papers fed.

[0009] In order to achieve the above and/or other aspects of the present invention, a printing apparatus is provided that comprises: a main body; a signal supply section to supply a signal indicative of types of paper fed from a paper feeding section provided to the main body; at least one friction member provided at an angle within a predetermined range in relation to the leading edge of a paper picked up from the paper feeding section, wherein the at least one friction member has an adjustable structure that is capable of changing within the predetermined range; at least one elastic member to elastically bias the at least one friction member in a first direction; a cam unit movably installed to the main body, wherein the cam unit forcibly moves the at least one friction member in a second direction opposite to the first direction to change the structure of the at least one friction member while the cam unit is being moved by a driving force; a driving force supply unit movably installed to the main body to supply a driving force to the cam unit at the time of being moved; and a control section to control the driving of the driving force supply unit based on the signal in relation to the type of the paper supplied from the signal supply section.

[0010] Additional aspects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0011] According to an aspect of the present invention, the cam unit comprises: a camshaft rotatably installed to the main body, having at least one projection contacted with the rear surface of the at least one friction member; and a link arm pivotably installed to the main body that connectively moves the camshaft to rotate the camshaft while being pivoted, the link arm being selectively pivoted by the driving force supply unit.

[0012] In addition, according to an aspect of the present invention, the driving force supply unit comprises: a carriage to receive an ink cartridge, installed to the main body so as to reciprocate; and a contact member connected to the carriage, wherein the contact member makes contact with the cam unit to forcibly move the cam unit to a predetermined area when the carriage moves.

[0013] According to another aspect of the present invention, the carriage is movable between a printing area to print an image on a paper and a home position spaced from the printing area, and the carriage interferes with the cam unit when the carriage moves from the printing area to the home position.

[0014] Furthermore, according to an aspect of the present invention, two or more friction members may be provided having a predetermined interval therebetween, and the camshaft may comprise two or more cam projections to correspond to the two or more friction members, respectively, and a link pin offset provided at a rotational center of the camshaft.

[0015] According to an aspect of the present invention, the link arm comprises: a slot at one end and a guide part at the other end, and the link pin is engaged in the slot and the guide part has a contact surface, which is slantly formed in relation to the direction of the rotational axis of the link arm and contacts with the driving force supply unit.

[0016] According to another aspect of the present invention, the signal supply section comprises a paper detection sensor to detect the type of paper loaded in the paper feeding section.

[0017] The signal supply section may also comprise memory to store information in relation to the type of paper inputted through a print driver in accordance with a user's choice.

[0018] Further, paper loaded in the paper feeding section may include a first type of paper having a thickness within a predetermined range, and a second type of paper thicker than the

first type of paper. In such a case, when the first type of paper is loaded in the paper feeding section, the control section drives the driving force supply unit so that the friction member is moved in the second direction to change the structure of the friction member.

[0019] According to an aspect of the invention, the friction member forms a larger angle in relation to the leading edge of a paper to be picked up when the friction member has been forcibly moved than when the friction member has been elastically biased.

[0020] According to another aspect of the present invention, a method of picking up paper in a printing apparatus is provided. Accordingly, the printing apparatus comprises: a main body; at least one friction member, installed to the main body, having a flexible structure to form an angle in relation to a leading edge of a paper picked up from a paper feeding unit and elastically biased in a first direction; a cam unit movably installed to the main body to forcibly move the at least one friction member in a second direction opposite to the first direction while the cam unit is being moved by driving force; and a driving force supply unit movably installed to the main body to supply a driving force to the cam unit at the time the cam unit is being moved. The method comprises: supplying a signal indicative of a type of paper to be picked up; classifying the paper to a first type having a thickness within a predetermined range or a second type thicker than the first type based on the signal; supplying driving force to the cam unit upon classifying the paper as the first type; moving the friction member to the second direction by driving the cam unit; and picking up the paper from the paper feeding section when the friction member has been moved in the second direction.

[0021] According to another aspect of the present invention the operation of supplying the signal comprises: supplying a detection signal from a detection sensor that detects the type of paper loaded in the paper feeding section provided to the main body.

[0022] According to another aspect of the present invention, the operation of supplying the signal comprises: supplying a signal from memory having stored information in relation to types of papers inputted through a print driver by a user.

[0023] Further, the printing apparatus may further comprise: a carriage installed to the main body to reciprocate between a printing area and a home position, and a contact member connected to the carriage to connectively move the cam unit when the carriage is moved. Accordingly, when the driving force is supplied and the carriage is positioned at the printing

area, the carriage positioned at the printing area is moved to the home position, and the contact member comes in contact with the cam unit when the carriage is moved to the home position.

[0024] According to another aspect of the invention, the printing apparatus further comprises: a link arm pivotably installed to the main body, and the cam unit having a camshaft provided with at least one cam projection. Accordingly, when the friction member is moved in the second direction, the link arm comes in contact with the driving force supply unit and receives driving force, thereby, being pivoted, the camshaft linked to the link arm is connectively rotated, and the cam projection makes contact with and compresses the rear surface of the friction member in the second direction while the cam projection is being rotated along with the camshaft.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The above and/or other aspects and advantages of the invention will become more apparent, and more readily appreciated from the following description of the preferred embodiments, taken in conjunction with accompanying drawings of which:

FIG. 1 is a schematic perspective view to show a printing apparatus according to an aspect of the present invention;

FIG. 2 is a block diagram to illustrate the printing apparatus according to an aspect of the present invention;

FIG. 3 is a cross-sectional view of a main part of the printing apparatus shown in FIG. 1;

FIG. 4 is a perspective view of the main part of the printing apparatus shown in Fig. 1;

FIG. 5 is a perspective view of a main part of the printing apparatus shown in FIG. 4;

FIG. 6 is a flowchart to illustrate a method to pick up a paper in the printing apparatus according to an aspect of the present invention;

FIG. 7 is a side elevational view to show the carriage positioned in the printing area; and

FIG. 8 is a side elevational view to show the carriage moved to the home position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout.

[0027] As shown in FIGS. 1 and 2, the printing apparatus according to an aspect of the present invention comprises: a main body 10; a paper feeding section 20 provided to the lower part of the main body 10; a pick-up unit 30 to pick up paper loaded to the paper feeding section 20; a signal supply section 40 to supply a signal indicative of a type of the paper loaded to the paper feeding section 20; at least one friction member 50 provided to a side of the paper feeding section 20; at least one elastic member 60 to elastically bias the at least one friction member 50 in a first direction; a cam unit 70 to move the at least one friction member 50 in a second direction opposite to the first direction while being moved by a driving force; a driving force supply unit 80 to supply the driving force to the cam unit 70; and a control section 90 to control the operation of the driving force supply unit 80.

[0028] As shown in FIG. 1, the main body 10 comprises: a base 11 and a main frame 13 installed to a top portion of the base 11. The top surface of the base 11 is provided with the paper feeding section 20to which sheets of paper to be picked are loaded.

[0029] The main frame 13 supports the pick-up unit 30, which picks up the paper provided to the paper feeding section 20, and the main frame 13 is provided with a transfer roller 14 to transfer the paper, a guide member, etc. In addition, the main frame 13 is also provided with a shaft 16 to support a carriage 15, wherein the carriage 15 reciprocates while carrying an ink cartridge. Further, a timing belt (not shown) and a driving motor (not shown) are also provided for reciprocating the carriage 15.

[0030] A plurality of papers are loaded to the paper feeding section 20 and are fed individually by the pick-up unit 30. The plurality of papers fed to the paper feeding section 20 are transferred below the carriage 15 through the friction member 50, the transfer roller 14, etc.

[0031] The pick-up unit 30, having a construction typically and widely employed in printing apparatus comprises a pick-up roller 31, and a roller shaft 33. The roller shaft 33 is connected to a pivot member that moves up and down. The pick-up roller 31 picks up paper while being rotated by the driving motor, which is not shown.

[0032] Further, the signal supply section 40 supplies a signal indicative of a type of paper and serves to provide information concerning a type of paper loaded to the paper feeding section 20, for example, information regarding thickness of the paper. The signal supply section 40 comprises: a sensor 41 to directly detect the type of paper loaded to the paper feeding section

20. The sensor 41 may be a light-receiving/emitting sensor or a resistance sensor, which detects the thickness of a paper by measuring a resistance value of the paper.

[0033] The signal supply section 40 may be provided with a memory 43 in which data values regarding types of paper inputted by a user through a printer driver are stored. Therefore, the control section 90 receives at least one data signal regarding the type of paper to be picked up, which is inputted to the memory 43, to determine the type of paper. In this case, the signals concerning the types of paper transmitted to the signal section 40 may be classified into a signal of a first type of paper having a thickness within a predetermined range, and a signal of a second type of paper thicker than the first type of paper.

[0034] The at least one friction member 50 is installed in such a way that a predetermined frictional force is provided to the leading edge of a paper to be picked. That is, the friction member 50 is installed to form an angle within a predetermined range in relation to the transfer direction of the picked-up paper, and to change the structure of the friction member within the range. As shown in FIG. 3, the lower end of the friction member 50 is pivotably supported on the base of the main body by a pivot pin 51, and the upper end is connected to the elastic member 60 and elastically biased to a first direction A. One end of the elastic member 60 is connected to the rear surface of the friction member 50, and the other end is connected to the base 11. In addition, the base 11 is provided with a projection rib 11a, against which the friction member 50 is abutted, so that the structure of the friction member 50 is fixed to move in the first direction A in one state. In this state, when a force is applied to the friction member 50 in the second direction B, the friction member 50 is further pivoted in the second direction B, thereby, allowing the structure of the friction member to change.

[0035] Accordingly, the angle formed between the friction member 50 and the leading edge of the paper when the friction member 50 is moved in the first direction A, as shown in FIG. 5, is larger than the angle formed when the friction member 50 is moved in the second direction B. Therefore, when the friction member 50 is moved in the first direction A, the frictional force between the friction member 50 and the leading edge of the paper will decrease. Accordingly, the position of the friction member 50 is adjusted to maintaining an angle appropriate to pick up the second type of paper, which is thicker in comparison to the first type of paper.

[0036] According to an aspect of the present invention, at least two friction members 50 are provided that are equi-spaced from each other and the position of all the friction members 50 concurrently changes to have uniform positions. The base 11 is formed with at least two equi-spaced projection ribs 11a, so that the projections 11a correspond to the friction members 50, respectively.

[0037] The cam unit 70 serves to push the friction members 50 to be moved by a driving force in the second direction, so that the friction members 50 change their position. As shown in FIGS. 4 and 5, the cam unit 70 comprises: a camshaft 71 rotatably installed to the main body 10, and a link arm 73 pivotably installed to the main body 10 and to connectively move the camshaft 71 so as to rotate the camshaft 71. The camshaft 71 is rotatably installed to the base 11, and provided with a plurality of cam projections 71a. The cam projections 71a are equi-spaced and contact with the rear surfaces of the friction members 50, respectively. If the cam projections 71a rotate in the direction C, the cam projections 71a compress and move the friction members 50 in the second direction B.

[0038] In addition, the camshaft 71 further comprises a link pin 71b at one end. The link pin 71b is provided spaced from the rotational center of the camshaft 71. The rotational axis of the link pin 71b is parallel to that of the camshaft 71.

[0039] The link arm 73 is pivotably installed to the main frame 13. One end of the link arm 73 is formed with a slot 73a in which the link pin 71b is engaged, and the other end is provided with a guide part 73b. When the link arm 73 pivots, the link pin 71b engaged in the slot 73a connectively moves the link arm 73, thereby, allowing the camshaft 71 to be rotated. The guide part 73b has a contact surface 73c, which is not parallel to, i.e. slanted in relation to the rotational axle 74 of the link arm 73. That is, the rotational axle 74 of the link arm 73 is installed parallel to a guide shaft 17 to be described later and the camshaft 71, while the guide part 73b is formed not to be parallel to each of the rotational axle 74 and the camshaft 71. As the driving force supply unit 80 comes into contact with the guide part 73 while the driving force supply unit 80 is moving, a driving force is supplied to the guide part 73b, whereby, the link arm 73 is made to be rotatable in the direction D.

[0040] As shown in FIG. 4, the driving force supply unit 80 comprises: a carriage 81 to reciprocate along the guide shaft 17 installed to the main body 10, and a contact member 83

connected to the carriage 81, where the contact member 83 selectively makes contact with and connectively moves the link arm 73 while moving with the carriage 81. The carriage 81 is reciprocated via a timing belt, which is not shown, when an ink cartridge 15 is received on the carriage. Here, the carriage 81 is movable between a predetermined printing area to print an image on a transferred paper, and a home position spaced from the printing area on either side. That is, the carriage 81 is positioned at the home position when the power source of the printing is turned off or during a stand-by state. However, during print operation or warm-up, the carriage 81 is positioned at the printing area. In the drawing, the home position is the position where the carriage 81 is confronted with the link arm 73 and the printing area is the section to which the arranged friction members 51 face.

[0041] The contact member 83 reciprocates along the guide shaft 17 along with the carriage 81, where the contact member 83 is extended towards the rear surface of the carriage 83 by a predetermined length. When the carriage 81 completes the movement from the printing area to the home position, the contact member 83 comes into contact with the guide part 73b or the contact surface 73 of the link arm 73 provided to be confronted with the home position and transfers driving force to the link arm 73. As a result, the link arm 73 is pushed by the contact member 83 and pivoted in the direction D. When the carriage 81 is positioned at the home position, the contact member 83 remains in contact with the guide part 73b.

[0042] The control section 90 controls the driving of the driving force supply unit 80. That is, the control section 90 receives a signal in relation to a type of paper to be picked up, where the signal is transmitted from the signal generation section 40, and determines whether the paper is of the first type or the second type of paper. Upon determining that the paper is of the first type, i.e. a relatively thin paper is loaded, the control section 90 controls the driving of the carriage 81, so that the carriage 81 is moved from the printing area to the home position. As a result, the cam unit 70 connectively moves the friction members 50 in the second direction B, so that the angle between the leading edge of a paper while being picked, and the friction members 50 is reduced. Then, a large frictional resistance is produced at the leading edge of the paper, thereby, preventing concurrent pick up of more than one sheet of paper.

[0043] According to an aspect of the present invention, a method to pick up paper using the printing apparatus is described in reference to FIG. 6.

[0044] At first, the printing apparatus is warmed up prior to performing the printing operation. In particular, in a case where the printing apparatus is an ink jet printer, the carriage 81 moves from the home position to the printing area, thereby, being in the stand-by position (operation 10). At this time, the carriage 81 is positioned in the printing area as shown in FIG. 5 and the link arm 73 does not make contact with the contact member 83. Therefore, as shown in FIG. 7, the friction members 50 remain offset from the first direction. In this state, an information signal in relation to a type of paper to be picked up is inputted into the control section 90 through the signal supply section 90 (operation 11). The control section 90 determines whether the paper to be picked up belongs to the first type of paper or the second type of paper based on the inputted information signal.

[0045] Upon determining that the paper belongs to the first type in operation 12, the control section 90 moves the carriage 81 to the home position. Then, as shown in FIG. 8, the contact member 83 moved along with the carriage 81 to the home position comes into contact with the contact surface 73c of the guide part 73b and the link arm 73 is pushed and rotated in the direction D by the contact member 83 (operation 14). In addition, the camshaft 71 connected to the link arm 73 is connectively moved with the link arm 73 and rotated in the direction C (operation 15). As such, the cam projections 71a provided on the camshaft 71 forcibly push the rear surfaces of the friction members 50. Accordingly, the friction members 50 are moved in the second direction (operation 16). When the friction members 50 are moved in the second direction in this manner, the angle formed between the friction members 50 and the leading edge of the paper when the paper is being picked up is reduced from the state shown in FIG. 7. As a result, the frictional resistance applied to the leading edge of the paper by the friction members 50 increases. In this state, the pick-up unit 30 is driven and picks up a paper from the paper feeding section 20 (operation 17). Then, even when two or more papers tend to be picked up, they are separated from each other and fed individually because the frictional resistance of the friction members 50 is large. After a paper is picked up, the carriage 81 is moved back to the printing area (operation 18). At this time, because the contact between the contact member 83 and the link arm 75 is released again, the friction members 50 are returned by the elastic force of the elastic members 60 in the first direction A. And, while the carriage 81 reciprocates in the printing area, an image is printed as the paper is being picked up and transferred.

[0046] Meanwhile, if a paper to be picked up in operation 12 belongs to the second type of paper, the friction members 50 is not moved in the second direction B. That is, in the case of a thick paper, if the friction members 50 are moved in the second direction B, the angle between the leading edge of the paper and the friction members 50 is reduced and, thus, a large frictional resistance is produced in the leading edge of the paper. In this case, the thick paper may be crumpled without being picked up due to the large frictional resistance or the pick-up roller may slide, whereby, the pick-up operation may not be performed. Therefore, in the case of the second type of paper, the paper may be picked up in the state in which the friction members 50 are laid offset from the first direction A.

[0047] As described above, according to an aspect of the present invention, it is possible to selectively change the position of the friction members according to a type of paper that is to be picked up.

[0048] Accordingly, when feeding a thick paper, it is possible to smoothly feed the paper by preventing a large resistance from being applied to the leading edge of the paper. Therefore, it is possible to solve the problem that the paper is crumpled or fails to get picked up.

[0049] In addition, when feeding a thin paper, it is possible to prevent two or more sheets of paper from being concurrently picked up because the structure of the friction members is automatically changed so that a larger resistance is applied to the leading edge of the paper.

[0050] Although a few embodiments of the present invention has been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and the spirit of the invention, the scope of which is defined in the claims and their equivalents.